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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/662,257	09/15/2003	Janos Rohaly	MITB-0003-P01	9034

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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No. 10/662,257	Applicant(s) ROHALY, JANOS	
	Examiner Nancy Bitar	Art Unit 2624	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 September 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 November 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *06/03/05, 11/10/03,09/15/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-18 are rejected under 35 U.S.C. 102(e) as being anticipated by Schöne et al (An Image Based Technique for low velocity free-surface flows, Jörg Schöne, July, 4,2002)

As to claim 1, Schöne et al teaches a method of processing at least first and second images of an image flow of an object to determine a relative displacement of elements of the image flow over a predetermined time interval (the central goal of an imaging technique is to measure the displacement of marked regions of a gaseous or liquid flow by observing the location of these markers in the image at two or more times, page 11, paragraph 2.1.1), the method comprising:

(a) recording a first array of pixel values associated with the first image of the image flow (P on the first image, figure 2.1, page 13);

(b) recording a second array of pixel values associated with the second image of the image flow; Q on the second image, figure 2.1, page 13) note that he particle positions

in a given flow can be recorded on a medium, e.g. a charge coupled device (CCD), photographic film or the tape of a video camera. Particles positioned in the field of view (plane in the flow) will be captured on the array of the recording medium (imaging plane) at several (known) time-intervals. Special software for PIV evaluation handles the data material gained in the previous step of recording. The particle displacements are determined by statistical means. A two-dimensional correlation (usually cross-correlation) is carried out for successive pairs of images, page 12, and paragraphs 3-4)

(c) defining a first plurality of interrogation regions on each of the first and second arrays of pixel values of the image flow and each of the first plurality of interrogation regions including a first minimal pixel resolution (divide each recorded image into interrogation area (IA), set an IA at P on the first image, choose another IA at Q on the second image, figure 2.1, page 13, see figure 4.21 and 4.22, page 56, note the size of the interrogation area is taught in paragraph 4.3.1 page 55);

(d) processing a first interrogation region from each of the first plurality of interrogation regions located on each of the first and second arrays of pixel values to provide a first correlation plane including a first plurality of signal values (calculate the cross-correlation coefficient R_{ab} then find the maximum R_{ab}, repeat sequence for all IA's, figure 2.1, page 13);

(e) detecting a first predetermined signal value from the first plurality of signal values associated with the first correlation plane (the result of the correlation produces a signal

peak, identifying the most likely particle displacement for the investigated IA, page 12, paragraph 5); and

(f) determining a direction and magnitude of the first predetermined signal value located on the first correlation plane which represents the relative displacement of elements of the image flow over the predetermined time interval (the magnitude of the marker displacements between two successive images can be determined in small regions, called interrogation areas. By means of a statistical method (e.g. cross-correlation) the displacement can be determined and finally a velocity vector for each interrogation area can be determined by dividing the displacement by the time interval between two successive recordings. The final vector field is determined by repeating this step, page 11, paragraph 2.1.1).

As to claim 2, Schöne et al teaches the method of claim 1, wherein if the direction and magnitude of the first predetermined signal value is unresolved, the method further includes:

(g) grouping predetermined ones of the first plurality of interrogation regions located on each of the first and second arrays of pixel values of the image flow to form a second plurality of interrogation regions on each of the first and second arrays of pixel values of the image flow and each of the second plurality of interrogation regions including a second minimal pixel resolution greater than the first minimal pixel resolution (figure 4.19 evaluation with an interrogation area of 32 x 32 pixels and figure 4.20 evaluation

with an interrogation area of 64x64 pixels, note that IA of 32 x 32 takes less than half the time than an IA of 64 x 64).

As to claim 3, Schöne et al teaches the method of claim 2, further including:

(h) processing a first interrogation region (set an IA at P, figure 2.1) from each of the second plurality of interrogation regions located on each of the first and second arrays of pixel values to provide a second correlation plane including a second plurality of signal values (the result of the correlation produces a signal peak, identifying the most likely particle displacement for the investigated IA's, page 12, paragraph 5).

As to claim 4, Schöne et al teaches the method of claim 3, further including:

(i) detecting a second predetermined signal value from the first plurality of signal values associated with the second correlation plane (the interrogation areas of each frame are cross-correlated with each other, pixel by pixel. The result of the correlation produces a signal peak, identifying the most likely particle displacement for the investigated IA, page 12, paragraph 5).

As to claim 5,Schöne et al teaches the method of claim 4, further including:

(j) determining a direction and magnitude of the second predetermined signal value located on the second correlation plane which represents the relative displacement of elements of the image flow over the predetermined time interval (page 73-74, paragraph 5.5.6, Detection of Flow Direction).

As to claim 6,Schöne et al teaches the method of claim 5, wherein if the direction and magnitude of the second predetermined signal value is unresolved, the method further includes:

(k) grouping predetermined ones of the second plurality of interrogation regions located on each of the first and second arrays of pixel values of the image flow to form a third plurality of interrogation regions ($\overrightarrow{PQ}_{max}$ and $\overrightarrow{U}$, figure 2.1, page 13) on each of the first and second arrays of pixel values of the image flow and each of the third plurality of interrogation regions (repeat sequence for all IA'a, figure 2.1) including a third minimal pixel resolution greater than the second minimal pixel resolution (figure 4.19 evaluation with an interrogation area of 32 x 32 pixels and figure 4.20 evaluation with an interrogation area of 64x64 pixels, note that IA of 32 x 32 takes less than half the time than an IA of 64 x 64).

As to claims 7-8,Schöne et al teaches the method of claim 6, further including:

(l) processing a third interrogation region from each of the third plurality of interrogation regions located on each of the first and second arrays of pixel values to provide a third correlation plane including a third plurality of signal values (note that Grow et al teaches n number of IA's from different images, figure 2.1).

(m) Detecting a third predetermined signal value from the third plurality of signal values associated with the third correlation plane (the interrogation areas of each frame are cross-correlated with each other, pixel by pixel. The result of the correlation produces a

signal peak, identifying the most likely particle displacement for the investigated IA, page 12, paragraph 5).

As to claim 9,Schöne et al teaches the method of claim 8, further including: (n) determining a direction and magnitude of the third predetermined signal value located on the third correlation plane which represents the relative displacement of elements of the image flow over the predetermined time interval (the magnitude of the marker displacements between two successive images can be determined in small regions, called interrogation areas. By means of a statistical method (e.g. cross-correlation) the displacement can be determined and finally a velocity vector for each interrogation area can be determined by dividing the displacement by the time interval between two successive recordings. The final vector field is determined by repeating this step, page 11, paragraph 2.1.1).

As to claim 10,Schöne et al teaches the method of claim 1, wherein processing further includes: interacting the first interrogation region from each of the first plurality of interrogation regions located on each of the first and second arrays of pixel values with a discrete (FFT) correlation function to provide the first correlation plane including the first plurality of signal values (the images from the two viewing angles were overlapped in the central region of the model such that markers of known coordinates located in the area were enclosed in each set of images, page 17, figure 2.3).

As to claims 11-12,Schöne et al teaches the method of claim 3, wherein processing further includes: processing at least one other interrogation region from each

of the first plurality of interrogation regions located on each of the first and second arrays of pixel values to provide at least one other correlation plane including a plurality of signal values; and combining the first correlation plane and the at least one other correlation plane to provide the second correlation plane (figure 2.3 and figure 2.1, figure 3.17).

As to claims 13-15,Schöne et al teaches the method of claim 1, further including: validating the first, second, and third predetermined signal value located on the first, second, and third correlation plane; and declaring that the relative displacement of elements of the image flow is locally complete if the direction and magnitude of first, second, and third predetermined signal value is validated (Image evaluation, page 12-14, And page 41-45).

As to claims 16 -17,Schöne et al teaches the method of claim 2, wherein grouping further includes grouping at least two interrogation regions of the first and second plurality of interrogation regions of each of the first and second arrays of pixel values to form each interrogation region of the second plurality of interrogation regions respectively located on each of the first and second arrays of pixel values (the correlation algorithm and FFT technique were chosen, every picture (frame) was exposed just once . A too small interrogation area (IA) might fail to detect the actual flow correctly, while a too large IA does not improve the result considerably and take a very long time for evaluation, page 44, paragraph3, figure 3.17).

As to claim 18,Schöne et al teaches the method according to claim 1, further including: associating at least one pixel value with each of the interrogation regions of the first plurality of interrogation regions defined on each of the first and second arrays of pixel values (figure 3.17 page 44, window size 32 x32 pixels, grid size 12x 12 pixels, maximal displacement 10 pixels).

Claim Rejections - 35 U.S.C. § 103

2. The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 19-21 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Schöne et al as applied to claims 1-18 above, and in view of Werner et al. (Complimentary Measurement of Geophysical Deformation using Repeat-Pass SAR, School of Geography, University of Leeds, UK, 2001 IEEE).

As to claim 19-21,Schöne et al teaches the method according to claim 1, wherein detecting the first, second, and third predetermined signal value from the first, second and third plurality of signal values associated with the first correlation plane includes detecting a first, second, and third signal value (figure 2.1, page 12-13). While Schöne et al. meets a number of the limitations of the claimed invention, as pointed out more

fully above, Schöne fails to specifically teach the oversampling the image flow. Specifically, Werner et al. teaches over-sampling of the image patches prior to cross-correlation followed by a two-dimensional regression fit to correlation function are performed. Because the oversampling of image flow to optimize the accuracy of the peak location (see Werner et al. paragraph 2.1, intensity tracking). It would have been obvious to one of ordinary skill in the art to detect the signal value based on oversampling the image flow as taught by Werner et al in Schöne et al invention since by over-sampling the image (i.e. resolving the image with 3-4 pixels across the image diameter), one can determine particle position to within an order of magnitude better resolution thus reducing some of the random noise introduces by the correlation tracking algorithm. Therefore, the claimed invention would have been obvious to one of ordinary skill in the art at the time of the invention by applicant.

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Wormell et al (US 5,491,642) is cited to teach fluid flow velocity measurement, and more particularly to particle image velocimetry (PIV) systems for two dimensional fluid flow analysis.

Muste et al (2005/0018882) is cited to teach recording successive images of controlled surface waves on the open channel flow with sufficient resolution to derive

spread of fronts of the controlled surface waves, using image velocimetry to derive celerity of controlled surface waves, and inferring the velocity vector field of the underlying liquid flow using wave theory elements or calibrations. An apparatus according to one aspect of the invention uses an artificial nonintrusive mechanism to set up the controlled surface waves, uses artificial light to illuminate the controlled surface wave to accentuate its affronts, digital camera to capture the successive images. Software can be used to utilizes image velocimetry and to infer the velocity vector field.

Sarrafzadeh-Khoee et al (US 6,097,477) is cited to teach provides very high temperature optical strain measurement instrumentation based on one-dimensional laser speckle imaging and digital cross correlation technique. The invention provides application of coherent laser beam illumination and scattering techniques for the measurement of optically rough surfaces displacements; integration of high-speed laser beam shutters and high-resolution linear array imaging cameras (triple-beam/triple-camera configuration) for the measurement of deformations as well as the surface strain; implementation of the microprocessor-based cross-correlation calculations for the detected one-dimensional speckle data to provide direct information on the surface strain and deformations; and development of a dedicated operating software program incorporating digital signal processing hardware/software modules, data acquisition devices and analysis for streamlined test measurement and control of the instrument. Innovations are provided in experimental mechanics and laser speckle metrology.

Hart et al (US 5,850,485) is cited to teach an image correlation includes providing one or more image arrays of pixel values wherein each pixel value is associated with one of a number of pixels. Pixel values in the image array, which are beyond a pixel threshold value, are selected and a correlation process is performed on the selected pixel values. The correlation process is preferably performed according to an error correlation function. The sparse array correlation process provides several orders of magnitude in increased processing speed over known correlation processing techniques and is useful for Particle Image Velocimetry analysis.

Washburn et al (6,077,226) is cited to teach imaging in which a region of interest is superimposed on a background image frame. In particular, the invention relates to methods and apparatus for adjusting a region of interest relative to a sector-shaped background image frame in ultrasound imaging of biological tissues.

Inquiries

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nancy Bitar whose telephone number is 571-270-1041. The examiner can normally be reached on Mon-Fri (7:30a.m. to 5:00pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Mancuso can be reached on 571-272-7695. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Nancy Bitar 12/1/2006

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SUPERVISORY PATENT EXAMINER